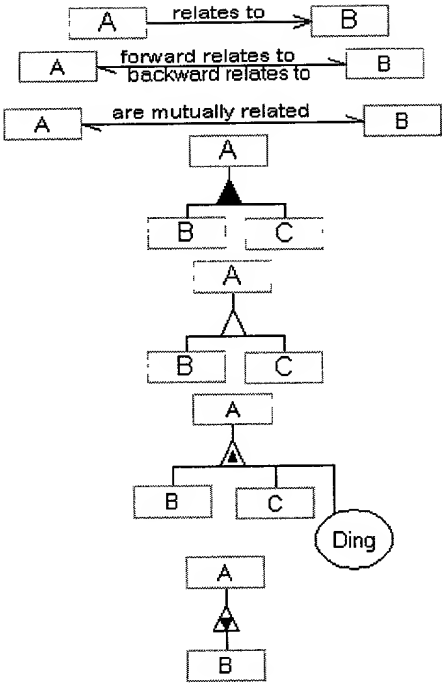
Appendix A



A relates to B. *Forward structure*

A forward relates to B and **B backward relates to A.**
Bi-directional structure sentence

A and **B are mutually related.** *Homologous*

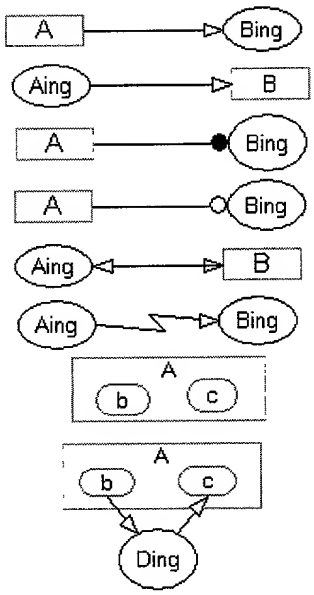
A consists of **B** and **C.** *Aggregation*

B and **C** are **As.** *Specialization sentence*

A exhibits **B** and **C.** as well as **Ding.** *Exhibition*

B is an instance of **A.** *Instantiation*

Behavior and state sentences



Bing consumes **A.** *Consumption sentence*

Aing yields **B.** *Result sentence*

A handles **Bing.** *Agent sentence*

Bing requires **A.** *Instrument sentence*

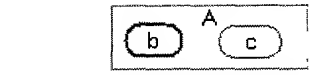
Aing affects **B.** *Effect sentence*

Aing invokes **Bing.** *Invocation sentence*

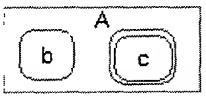
A can be **b** or **c.** *State enumeration sentence*

Ding changes **A** from **b** to **c.** *Change sentence*

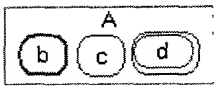
Fixing changes **Car** from **broken** to **fixed.** *Change sentence*



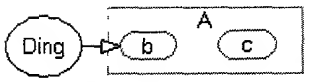
A is initially **b.** *Initial state specification*



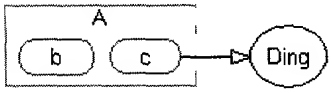
A is ultimately **c.** *Ultimate state specification sentence*



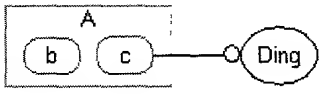
A is initially **b** and ultimately **c.** *Initial and ultimate state specification*



Ding yields **b A.** *State-specified result sentence*

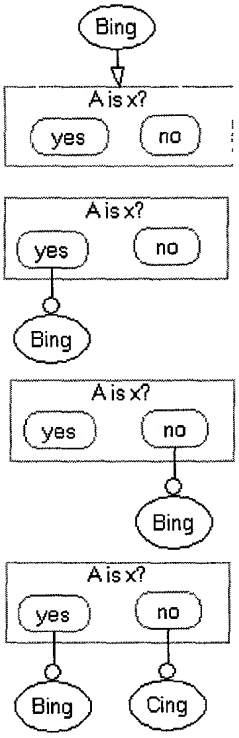


Ding consumes **c A.** *State-specified consumption sentence*



Ding requires **c A.** *State-specified instrument sentence*

Boolean sentences



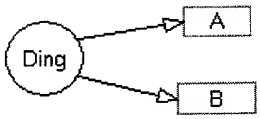
Bing determines whether **A** is **x.** *Determination sentence*

Bing occurs if **A** is **x.** *Condition sentence*

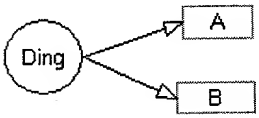
Bing occurs if **A** is not **x.** *Negative condition sentence*

Bing occurs if **A** is **x,** otherwise **Cing** occurs. *Compound condition*

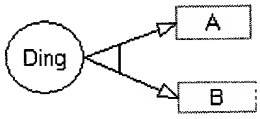
Logical operation and probabilistic sentences



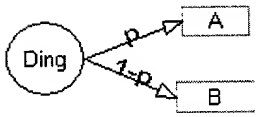
Ding yields **A** and **B.** *And result sentence*



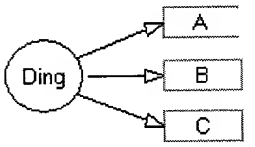
Ding yields either **A** or **B.** *Exclusive or result sentence*



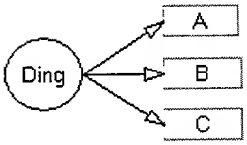
Ding yields **A** or **B.** *Or result sentence*



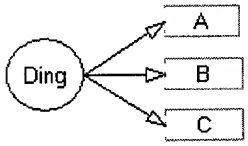
Ding yields either **A,** with probability **p,** or **B,** with probability **1- p.**
Probabilistic exclusive or result sentence result sentence



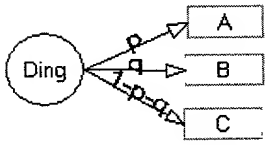
Ding yields **A, B,** and **C.** *And result sentence*



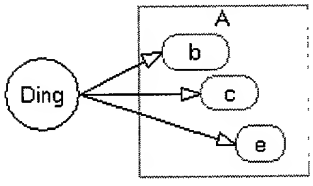
Ding yields either **A** or **B** or **C.** *Exclusive or result sentence*



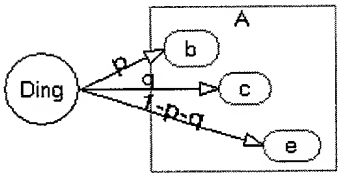
Ding yields **A** or **B** or **C.** *Or result sentence*



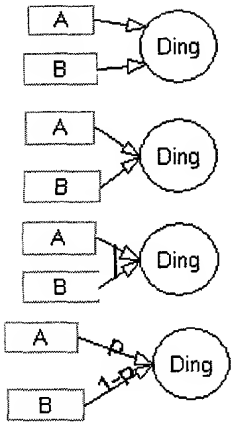
Ding yields either **A,** with probability **p,** or **B,** with probability **1- p.**
Probabilistic result sentence result sentence



Ding yields either **b A** or **c A** or **e A.** *Exclusive or result sentence*



Ding yields either **b A,** with probability **p,** or **c A,** with probability **q,** or **e A,** with probability **1-p-q.** *Probabilistic result sentence*



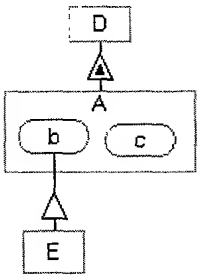
Ding consumes **A** and **B.** *And consumption sentence*

Ding consumes either **A** or **B.** *Exclusive or consumption sentence*

Ding consumes **A** or **B.** *Or consumption sentence*

Ding consumes either **A,** with probability **p,** or **B,** with probability **1- p.**
Probabilistic consumption sentence

Qualification sentences



E is a **D,** the **A** of which is **b.** *Compound condition sentence*

Airplane is a **vehicle,** the **Traveling Medium** of which is **water.**

Appendix B

Notational Conventions

(1) */chararcter* denotes an ASCII character, e.g., */period is "." /space is " ", /comma is ",".*

(2) || denotes string concatenation.

(3) $(pattern)^{?}$ means optional (zero or one) repetitions of pattern.

$(pattern)^{*}$ means zero or more repetitions of pattern.

$(pattern)^{+}$ means at least one repetition of pattern.

$(pattern)^{n+}$ means at least n repetitions of pattern.

(4) (?!pattern) is a Perl regular expression convention called a zero-width negative lookahead assertion. For example /foo(?!bar)/ matches any occurrence of ``foo" that isn't followed by ``bar". So this means that *Object-name must not end with the* ing suffix, or, if it does end with ing it must be followed by the reserved word Object. Example: Ready Casting Object.

Likewise, a process name must end with ing, *and if it does not, it must be followed by the reserved word* Process. Example: Initiation Process.

(5) a → a | A underlined non-capital letter designates a non-capital or capital letter.

(6) A production right hand side which contains the phrase *"English syntax for"* means that the grammar must follow the syntax of English. Example: *English syntax for* ***Irregular-Plural-Form***

(7) *A | B → C* is shorthand for *A → C and B → C*

(8) ↓ is string stripping - the reverse operation for string concatenation. *A↓a* means the string *A* from which the string *a* was stripped. Example:

Boolean-object-name → Boolean-assertion|| /question-mark

Boolean-assertion → Boolean-object-name↓/question-mark

(9) Non bold Arial words denote reserved terminal. **Bold Arial** words denote non-reserved terminals.

(10) /* This is a comment */

Production rules

S → *Formal-sentence /period*

Formal-sentence → *Generic-attribute-sentence*

| *Structure-sentence* | *State-sentence*

| *Behavior-sentence* | *Control-sentence*

| *Complexity-management-sentence*

Generic-attribute-sentence → *Thing-name* is (a | an) *Generic-attribute-list* (**Object** | **Process**)

Generic-attribute-list → *Generic-attribute* (and *Generic-attribute*)

Generic-attribute → Physical | Environmental | Transient | Natural | ϕ

/* Physical *is the non-default value of* Essence,

the default value of which is Informatical. */

/* Environmental *is the non-default value of* Affiliation,

the default value of which is Systemic. */

/* Transient *is the non-default value of* Persistence,

the default value of which is Persistent. */

/* Natural *is the non-default value of* Origin,

the default value of which is Artificial. */

Structure-sentence → *Tagged-strucutre-sentence* | *Fundamental-strucutre-sentence*

Tagged-strucutre-sentence → *Forward-strucutre-sentence*

| *Bi-directional-strucutre-sentence*

| *Homologous-strucutre-sentence*

Forward-strucutre-sentence → *Source-object-name Forward-tag Destination-object-name*

Backward-strucutre-sentence → *Destination-object-name Backward-tag Source-object-name*

Bi-directional-strucutre-sentence → *Forward-strucutre-sentence* and *Backward-strucutre-sentence*

Homologous-strucutre-sentence → *Object-name* and *Object-name* are *Homologous-tag*

Source-object-name | *Destination-object-name* → *Object-name*

Forward-tag | *Forward-tag Backward-tag* | *Homologous-tag* → *Non-capitalized-phrase*

Capitalized-phrase → *Capitalized-word* (*/space*)$^{+}$ (*Capitalized-word* (*/space*)$^{+}$)*

Non-capitalized-phrase → *Non-capitalized-word* (*/space*)$^{+}$ (*Non-capitalized-word* (*/space*)$^{+}$)*

Capitalized-word → *Capital-letter* (*Character*)*

Non-capitalized-word → *Letter* (*Character*)*

Capital-letter → **[A..Z]**

Character → *Letter* | *Digit* | - | &

Letter → **[a..z, A..Z]**

Digit → **[0..9]**

Single → a | an | an optional | at least one

Plural → optional | many | *Number*

Object-name → *Single*$^{?}$ *Capitalized-phrase* (?!**ing**)

| *Single*$^{?}$ *Capitalized-phrase*||ing Object

| *Plural*$^{?}$ *Object-plural-name*

Object-plural-name → *Capitalized-phrase*(?!**ing**)||**s**

| *English syntax for* ***Irregular-Plural-Form***

| *Capitalized-phrase*(?!**ing**)||**ing** Objects

Object-list → (*Object-name/comma/space*)$^{2+}$ and *Object-name* |

Object-name and *Object-name* | *Object-name*

Process-name → *Single*$^{?}$ *Capitalized-phrase*||**ing**)

| *Single*$^{?}$ *Capitalized-phrase*(?!**ing**) Process

| *Plural*$^{?}$ *Process-plural-name*

Process-plural-name → *Capitalized-phrase*(?!**ing**)||**ings**

| *Capitalized-phrase*(?!**ing**) Processes

Process-list → (*Process-name /comma /space*)$^{2+}$ and *Process-name* |

Process-name and *Process-name* | *Process-name*

Thing-list → *Object-list* | *Process-list* | *Process-and-Object-list* | *Object-and-Process-list*

Process-and-Object-list → *Process-list/comma* as well as *Object-list*

Object-and-Process-list → *Object-list/comma* as well as *Process-list*

Number → *Integer* | *Real*

Integer → [(two | 2) .. (ten, 10), 11 .. 999999999999]

Real → (*Digit*)* */period* (*Digit*)$^{+}$

Fundamental-strucutre-sentence → *Aggregation-sentence*

| *Exhibition-sentence*

| *Specialization-sentence*

| *Instantiation-sentence*

Aggregation-sentence → *Object-name* consists of *Object-list*

| *Process-name* consists of *Process-list*

Exhibition-sentence → *Thing-name* exhibits *Object-list*

| *Object-list /comma* and *Process-list*

| *Process-list*

Specialization-sentence → *Object-specialization-sentence* | *Process-specialization-sentence*

Object-specialization-sentence → *Object-name* is (a | an) *Object-name*

| *Object-list* are *Object-name*

Process-specialization-sentence → *Process-name* is (a | an) *Process-name*

| *Process-list* are *Process-name*

Instantiation-sentence → *Object- Instantiation-sentence* | *Process-Instantiation-sentence*

Object-Instantiation-sentence → *Object-name* is an instance of *Object-name*

| *Object-list* are instances of *Object-name*

Process-Instantiation-sentence → *Process-name* is an instance of *Process-name*

| *Process-list* are instances of *Process-name*

State-sentence → *State-enumeration-sentence*

State-enumeration-sentence → *Object* can be *State-list*

State-list → (*State-name/comma/space*)$^{2+}$ or *State-name* |

State-name or *State-name* | *State-name*

Behavior-sentence → *Enabling-sentence* | *Transformation-sentence* | *Invocation-sentence*

Enabling-sentence → *Agent-sentence* | *Instrument-sentence*

Agent-sentence → *Object-name* handles *Process-list* | *Object-list* handle *Process-list*

Instrument-sentence → *Process-name* requires *Object-list* | *Process-list* require *Object-list*

Transformation-sentence → *Consumption-sentence* | *Result-sentence*

| *Effect-sentence* | *Change-sentence*

Consumption-sentence → *Process-name* consumes *Object-list*

Result-sentence → *Process-name* yields *Object-list*

Effect-sentence → *Process-name* affects *Object-list* | *Process-list* affect *Object-list*

Change-sentence → *State-change-sentence* | *Value-change-sentence*

State-change-sentence →

Process-name changes *Object-name* from *Source-state-name* to *Destination-state-name*

| *Source-state-change-sentence*

| *Destination-state-change-sentence*

Source-state-change-sentence → *Process-name* changes *Object-name* from *Source-state-name*

Destination-state-change-sentence →

Process-name changes *Object-name* to *Destination-state-name*

Source-state-name | *Destination-state-name* → *State-name*

State-name → *Non-capitalized-word*

Value-change-sentence → *Process-name* changes *Object-name* from *Value-name* to *Value-name*

Value-name → *Number* | *Capitalized-word*

Invocation-sentence → *Process-name* invokes *Process-name*

Control-sentence → *Determination sentence*

| *Condition-sentence* | *Negative-condition-sentence*

| *Compound-condition-sentence* | *Case-sentence*

Determination sentence → *Process-name* determines whether *Boolean-assertion*

/ Boolean-object-name* → *Boolean-assertion*|| ?

Boolean-assertion → *Boolean-object-name*↓? */*

Boolean-assertion is *Boolean-object-name* from which the *question-mark* which is mandatory at the end of *Boolean-object-name* was stripped. **/*

Boolean-assertion → *Opening-Boolean-phrase* is *Closing-Boolean-phrase*

Negated-Boolean-assertion → *Opening-Boolean-phrase* is not *Closing-Boolean-phrase*

Opening-Boolean-phrase | *Closing-Boolean-phrase* → *Capitalized-phrase*

Condition-sentence → *Process-name* occurs if *Boolean-assertion*

Negative-condition-sentence → *Process-name* occurs if *Negated-Boolean-assertion*

Compound-condition-sentence → *Positive-process-name* occurs if *Boolean-assertion /comma* otherwise *Negative-process-name* occurs

Case-sentence → (*Case-phrase/comma*)$^{2+}$ and *Case- phrase*

| *Case-phrase* and *Case- phrase*

Case-phrase → In case *Object-name* is *State-name/comma Process-name* occurs

Positive-process-name | *Negative-process-name* → *Process-name*

Complexity-management-sentence → *Diagram-expansion-sentence*

| *Detailing-sentence* | *Abstracting-sentence*

Diagram-expansion-sentence → *Single-thing-expansion-sentence*

| *Many-things-expansion-sentence*

Single-thing-expansion-sentence → *Thing-name* in *Diagram-id* is expanded in *Diagram-id*

(|| */comma* while (*Thing-name* is condensed | *Thing-list* are condensed))$^{?}$

Many-things-expansion-sentence → *Thing-list* in *Diagram-id* are expanded in *Diagram-id*

(|| */comma* while (*Thing-name* is condensed | *Thing-list* are condensed))$^{?}$

Thing-name → *Object-name* | *Process-name*

Thing-list → *Object-list* | *Process-list*

| *Object-list* along with *Process-list* | *Process-list* along with *Object-list*

Diagram-id → SD || (*/dash integer*)*

Detailing-sentence → *Process-detailing-sentence*

| *Object-detailing-sentence*

| *State-detailing-sentence*

Process-detailing-sentence → *Process-name* zooms into *Thing-list*